

THE INDICATOR IMPREGNATED FIBROUS CHEMISORBENTS OF SULFUR DIOXIDE BASED ON SODIUM, MONOETHANOLAMMONIUM, AND POLYETHYLENEPOLYAMMONIUM CITRATES

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References:

1. *Handbook of Respiratory Protection*. Ed. by Racz, L. A.; Yamamoto, D. P.; Eninger, R. M. CRC Press **2017**, 579 p. <https://doi.org/10.4324/9781351109079>
2. Johnson, J. S. Respiratory Protective Devices. In: *Handbook of Occupational Safety and Health*. Ed. by Mansdorf, S. Z. John Wiley & Sons **2019**, 495–530. <https://doi.org/10.1002/9781119581482>
3. Beluomini, M. A.; Silva, J. L.; Sá, A. C.; Buffon, E.; Pereira, T. C.; Stradiotto, N. R. Electrochemical Sensors Based on Molecularly Imprinted Polymer on Nanostructured Carbon Materials: A Review. *J. Electroanal. Chem.* **2019**, *840*, 343–366. <https://doi.org/10.1016/j.jelechem.2019.04.005>
4. Moon, S. M.; Lee, S.; Min, H.; et al. Design and Integration of a Gas Sensor Module that Indicates the End of Service Life of a Gas Mask Canister. *Adv. Mater.* **2022**, *7*(3), An 202100711. <https://doi.org/10.1002/admt.202100711>
5. Gardner, P. D. Multi-Agent End-of-Service-Life Indicator for Respirator Filters. US Patent 7442237B1. USPTO **2008**, Filed 08.09.2005; Published 28.10.2008.
6. Attar, A. J. End of Service and Residual Life Indicator. US Patent 7503962B2. USPTO **2009**, Filed 16.12.2005; Published 17.03.2009.
7. Khoma, R. E.; Ennan, A. A.-A.; Bienkovska, T. S.; et al. The Impregnated Fibrous Chemisorbents for Colorimetric Detection of the Sulfur Dioxide. *Ukr. Khim. Zh.* **2022**, *87*(1), 35–48. <https://doi.org/10.33609/2708-129X.88.01.2022.35-48>
8. Bienkovska, T.; Khoma, R.; Vatrál, O.; et al. Impregnated Fibrous Chemisorbents for the Colorimetric Detection of Ammonia. *Ukr. Khim. Zh.* **2022**, *88*(12), 175–188. <https://doi.org/10.33609/2708-129X.88.12.2022.175-188>
9. Ennan, A. A.-A.; Khoma, R. E.; Dlubovskii, R. M.; et al. Mono- and Bifunctional Impregnated Fiber Chemisorbents for Respiratory Purpose. *Visn. Odes. Nats. Univ. Khim.* **2022**, *27*(1), 6–36. [https://doi.org/10.18524/2304-0947.2022.1\(81\).248297](https://doi.org/10.18524/2304-0947.2022.1(81).248297)
10. Liu, C.-C.; Wang, Y.-N.; Fu, L.-M.; Yang, D.-Y. Rapid Integrated Microfluidic Paper-Based System for Sulfur Dioxide Detection. *Chem. Eng. J.* **2017**, *316*, 790–796. <https://doi.org/10.1016/j.cej.2017.02.023>
11. Ding, C.; Ren, Y.; Liu, X.; Zeng, J.; Yu, X.; Zhou, D.; Li, Y. Detection and Discrimination of Sulfur Dioxide Using a Colorimetric Sensor Array. *RSC Adv.* **2022**, *12*, 25852–25859. <https://doi.org/10.1039/D2RA04251G>
12. Wang, Z.; Hao, C.; Li, N.; et al. Visual Colorimetric Label for Real-Time Monitoring of SO₂ Concentration Change in Grape and Mango During Storage. *Food Chem.* **2025**, *463*(Pt 4), An141530. <https://doi.org/10.1016/j.foodchem.2024.141530>
13. Chebotaryov, O. M.; Snigur, D. V. Colorimetry in Acid-Base Equilibria Study in Polyfunctional Organic Compounds Solutions. *Odesa I. I. Mechnikov Natl. Univ.* **2020**, 122 p.
14. Khoma, R. E.; Bienkovska, T. S.; Bugova, E. Yu.; et al. SO₂ – Am (KOH) – Tropeolin OOO – H₂O (Am – Ethanolamines, Morpholine) Systems Acid-Base Properties. *Visn. Odes. Nats. Univ. Khim.* **2022**, *27*(3), 43–52. [https://doi.org/10.18524/2304-0947.2022.3\(83\).268625](https://doi.org/10.18524/2304-0947.2022.3(83).268625)
15. Patnaik, P. *Dean's Analytical Chemistry Handbook*, 2nd ed.; McGraw-Hill: New York, **2003**, 1114 p.
16. Sabnis, R. W. *Handbook of Acid-Base Indicators*; CRC Press: Boca Raton, **2008**, 416 p.
17. Vankar, P. S.; Bajpai, D. Rose Anthocyanins as Acid-Base Indicators. *Electron. J. Environ. Agric. Food Chem.* **2010**, *9*(5), 875–884.
18. Snigur, D. V. The Use of Tristimulus Colorimetry Functions in the Study of the Acid-Base Equilibria in Solutions of Organic Compounds. *Ph.D. Dissertation*, Uzhgorod, **2017**, 140 p.
19. Naseem, K.; Farooqi, Z. H.; Begum, R.; Irfan, A. Removal of Congo Red Dye from Aqueous Medium by Its Catalytic Reduction Using Sodium Borohydride in the Presence of Various Inorganic Nano-Catalysts: A Review. *J. Cleaner Prod.* **2018**, *187*, 296–307. <https://doi.org/10.1016/j.jclepro.2018.03.209>
20. Aragoni, M. C.; Arca, M.; Crisponi, G.; et al. Characterization of the Ionization and Spectral Properties of Sulfonephthalein Indicators. Correlation with Substituent Effects and Structural Features. Part II. *Talanta* **1995**, *42*(8), 1157–1163. [https://doi.org/10.1016/0039-9140\(95\)01559-t](https://doi.org/10.1016/0039-9140(95)01559-t)
21. Shokrollahi, A.; Gohari, M.; Ebrahimi, F. Determination of Acidity Constants of p-Rosolic Acid and Bromoxyleneol Blue by Solution Scanometric Method. *Anal. Bioanal. Chem. Res.* **2018**, *5*(1), 67–79. <https://doi.org/10.22036/ABCR.2017.89026.1153>

22. Apelblat, A. *Citric Acid*; Springer: Cham, **2014**, 357 p. <https://doi.org/10.1007/978-3-319-11233-6>
23. Khoma, R. E.; Bienkovska, T. S.; Tsyganenko, K. V.; et al. Acid-Base and Electrochemical Behavior of Monoethanolamine (Polyethylenepolyamine) – Citric Acid – Water Solutions. *J. Chem. Technol.* **2024**, 32(1), 30–42. <https://doi.org/10.15421/jchemtech.v32i1.292412>
24. Li, Z.; Huang, J.; Wang, L.; et al. Novel Insight into the Role of Sulfur Dioxide in Fruits and Vegetables: Chemical Interactions, Biological Activity, Metabolism, Applications, and Safety. *Crit. Rev. Food Sci. Nutr.* **2023**, 64(24), 8741–8765. <https://doi.org/10.1080/10408398.2023.2203737>
25. Issa, Y. M.; El-Hawary, W. F.; Youssef, A. F. A.; Senosy, A. R. Synthesis and Structural Study of the Ion-Associates of Sildenafil Citrate with Chromotropic Acid Azo Dyes. *Eur. Chem. Bull.* **2012**, 1(6), 205–209.